

CSCI 3104
Problem Set 7

Name: Maura Kieft
ID: 103947905
Profs. Grochow & Layer
Spring 2019, CU-Boulder

3. Prof. Dumbledore needs your help to compute the in- and out-degrees of all vertices in a directed multigraph G . However, he is not sure how to represent the graph so that the calculation is most efficient. For each of the three possible representations, express your answers in asymptotic notation (the only notation Dumbledore understands), in terms of V and E , and justify your claim.

- (a) (5 pts) An *adjacency matrix* representation. Assume the size of the matrix is known.

The adjacency matrix will be a 2D array of size $V \times V$, in which V is the number of vertices in the Graph.

Letting the 2D array be adj , $adj[i][j]=1$ tells us that there is an edge from vertex i to vertex j .

In order to calculate the out-degree of all the vertices in the directed multigraph G , we need to access all the rows and to calculate in-degree we need all the columns which will efficiently calculate what Dumbledore needs to access. The time complexity while using an adjacency matrix representation will be $O(V \times V) = O(V^2)$.